

20 - 80 kVA UPS  
User's and Installation  
Manual



# 20 - 80 kVA UPS

## User's and Installation Manual

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Revision D

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# 1. Introduction

This User's manual gives basic information about 20 - 80 kVA, uninterruptible power supplies: their basic function, their features, how to use them, and what to do in case of trouble. Instructions for shipping, storing, handling and installing the equipment are also given.

The planning guidelines of this manual describe only the specific demands of UPS units. Local legislation and regulations for electrical installations must be followed in the UPS installation.

This manual is mainly intended for the chief operator/system supervisor, electrical consultants and installation electricians.

The UPS system must be installed according to the instructions in this manual. Fixed installation may be performed by qualified personnel only. Failure to recognise the electrical hazards could prove fatal.

## 2. System description

A UPS (Uninterruptible Power Supply) protects different types of sensitive electrical equipment: computers, workstations, sales terminals, critical instrumentation, telecommunications systems, process control systems, etc. The UPS protects them from problems associated with utility power of poor quality, or a complete loss of power.

Sensitive electrical equipment needs protection from electrical interference. Interference from outside the facility (such as lightning, power company accidents and radio transmissions) and interference from inside the facility (from motors, air conditioners, vending machines and arc welders, for example) can create problems in the AC power line for the sensitive equipment. The problems can be: power outage, low or high voltage, slow voltage fluctuation, frequency variations, differential and common-mode noise, transients, etc.

The UPS cleans the utility AC power, maintains a constant voltage and if needed isolates the output to the critical load. These actions help to keep power line problems from reaching the critical system, where they can damage software and hardware and cause the equipment to operate erratically.

### 2.1 General description

This UPS is a double conversion on-line UPS for protection of computer systems and other intelligent devices such as measurement instruments and industrial automation applications. It conditions the raw mains and supplies continuous, clean three-phase power to the critical systems. While feeding the load the UPS also keeps the battery constantly charged. If utility power fails, the UPS will continue to supply clean power without any interruption at the UPS output.

If the power failure outlasts the backup time the UPS will shut down in order to prevent a total discharge of the battery. When the line voltage is restored the UPS will start up again automatically providing power to the critical load and charging the battery bank.

UPS block diagram shown in fig. 1, consists of several modules each having its own functions:

- Transients on the mains are reduced by an input filter.
- AC-power is rectified and regulated in the rectifier which provides the power to the inverter and the battery charger to keep the battery bank fully charged.
- The inverter converts the DC-power back to AC-power, which is delivered to the load.
- The static switch transfers the load to the bypass line when the inverter is overloaded or the inverter is not able to feed the load. The new Efficiency Optimizer function allows the static switch to transfer the load to the bypass line also when the mains power is smooth and free from disturbances. See below for more information about this new feature.
- The battery provides power to the load during a mains failure.
- The battery charger keeps the battery fully recharged.
- The battery switch determines the direction of the current to or from the battery. In normal mode the mains is supplying the load, the switch is open and the battery is kept fully recharged. When there is a failure in the mains supply, the switch is closed and the battery is feeding the load.
- The control and monitoring circuits with ABM-system (Advanced Battery Management) monitor and control the operation of the UPS-system including automatic battery testing. They show the user the status of the system operation by visual and audible indicators. The UPS sends information about the system operation via potential free relay outputs and two serial data interfaces (RS232). (UPS can be shut down remotely via computer interface.) This information includes data about the utility, the load and the UPS itself. The information can be used in a computer to ensure total protection of software and data.
- Maintenance bypass switch is used to bypass the UPS during maintenance or service.

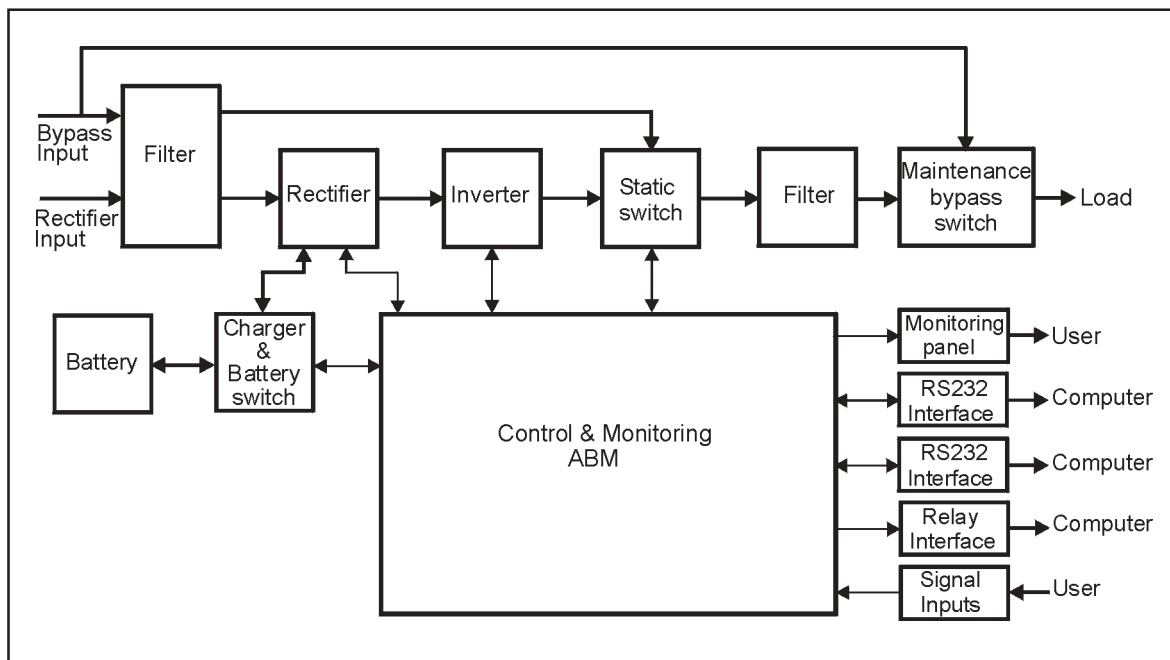


Figure 1. Block diagram of the UPS.

## Efficiency Optimizer

In addition to the traditional on-line operation mode this UPS features the Efficiency Optimizer function - a new feature adding real cost effectiveness to the UPS. It minimises the power loss and reduces power consumption. The UPS automatically switches between bypass and on-line mode according to the utility power condition. Whenever there are imperfections in the mains supply the UPS feeds power in on-line mode. When mains power is smooth and free from disturbances the UPS switches automatically to bypass mode for maximum efficiency. If needed, UPS detects all mains imperfections in a fraction of a second and turns back to on-line mode. As a result the UPS reaches up to 98% average efficiency. The Efficiency Optimizer function is standard in this UPS and can easily be activated via the serial interface port during initial start up by the service engineer. The UPS can of course run permanently in traditional on-line mode if preferred. All models of 20 - 80 kVA UPSs run in the traditional on-line mode as default.

## 2.2 System configuration

The UPS system consists of the UPS device itself and the external backup battery. In addition, several options may be included in the system. The options are used to tailor a matching solution to fulfil the site and load requirements of the installation.

The main considerations in planning the UPS system are:

- The UPS output power rating (VA) shall be specified according to the total power demand of the protected system. Some margin should be allowed for potential expansion of the protected system, and for possible inaccuracy in calculating or measuring the actual power requirement.
- The battery shall be sized according to the desired backup time. Note that the backup time is longer if the load is less than the nominal power rating of the UPS.

The following options are available:

- Output isolation transformer
- 10% input filter (THDI)
- External battery cabinets
- Remote display unit (ViewUPS)
- Alarm extension unit
- LanQuattro
- Connect UPS (SNMP adapter)

Table 1. describes UPS equipment backup times of battery options related to the UPS ratings.

UPS Output power	Internal Batteries	BAT D	BAT E	BAT F	2xBAT E
UPS 20 kVA/14 kW	12(7) min	25 min	45 min	90 min	110 min
UPS 30 kVA/21 kW	7 min	15 min	28 min	55 min	65 min
UPS 40 kVA/28 kW	-	10 min	19 min	35 min	45 min
UPS 50 kVA/35 kW	-	7 min	13 min	25 min	35 min
UPS 60 kVA/42 kW	-	-	10 min	20 min	28 min
UPS 80 kVA/56kW	-	-	-	11 min	15 min

Table 1.

The backup times are for standard batteries and long life batteries.

The backup times indicated in parentheses are for units with battery banks of 32 pcs battery system.

See the dimensions of the UPS series and different battery options in figure 2.

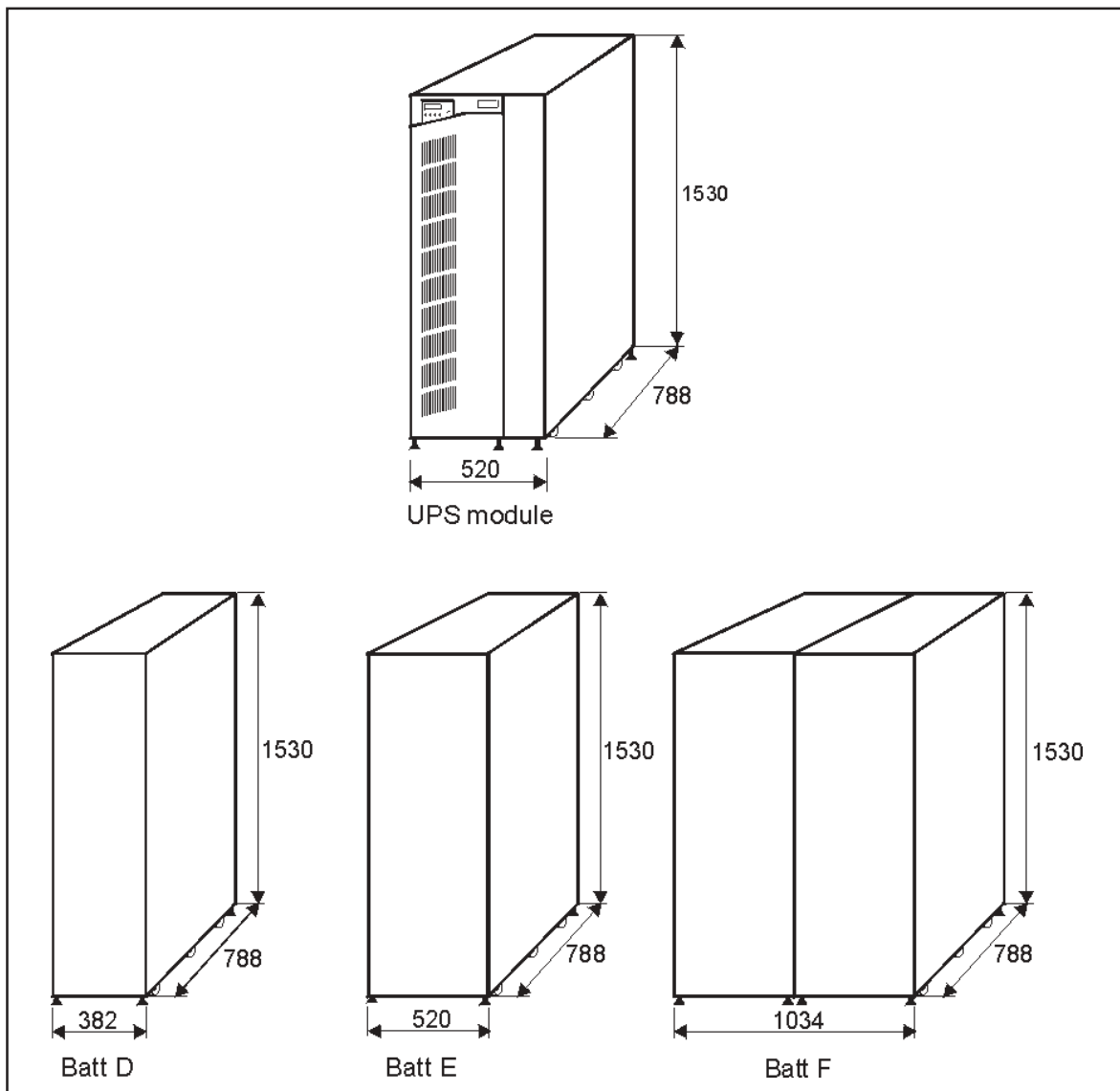


Figure 2. Dimensions of the UPS and the battery cabinets.

### 3. Safety information

Since the UPS unit operates on line power and contains a bank of high-current backup batteries, the information in this chapter is important to all personnel involved.

#### Storage and transportation

Because of the heavy weight of the cabinets and the high energy battery bank the equipments must be handled with care. The UPS must always be kept in the position marked on the package and must not be dropped.

#### Installation

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a safety hazard. Do not place the UPS in an airtight room.



The UPS system must be installed according to the instructions in this manual. Installation may be performed by qualified personnel only. Failure to recognise the electrical hazards could prove fatal.



#### WARNING!

**Do not open the UPS cabinet! Some components inside the UPS cabinet carry high voltages. To touch them may prove fatal. All operations inside the unit must be carried out only by a service engineer from the manufacturer or from an agent authorised by the manufacturer.**



#### WARNING!

**The UPS is not provided with automatic backfeed isolation. A readily accessible disconnect device must be installed in the fixed wiring. See chapter 6.5.**

### User operations

The only user operations permitted are:

- Starting up and shutting down the UPS unit (not the initial start up).
- Operating the user interface.
- Connecting data interface cables.
- Monitoring the UPS with LanSafe III or PowerVision software.

These operations must be performed according to the instructions in this manual. During any of these operations, the user must take greatest care, and perform only the prescribed operations. Any deviation from the instructions could be dangerous to the operator.

## 4. Shipping and storage

The UPS equipment is shipped on specifically designed pallets so that it is easy to move with a forklift.

Do not stack the pallets.

Because of the high energy stored within batteries, the UPS and the battery cabinet must be handled with care. The UPS must always be kept in an upright position and must not be dropped.

Because of the heavy weight of the UPS system proper provision must be made for transportation. See technical specifications for dimensions and weights of the UPS.

If the UPS is not immediately installed the following must be remembered:

- The UPS should be stored in the original packing and shipping carton.
- The **recommended** storing temperature is between +15°C ... +25°C.
- The equipment must always be protected from moisture and weather.

If the UPS is stored for a longer period of time the batteries of the UPS should be charged for at least 8 hours every 6 months to maintain the battery condition.

## 5. Unpacking and handling

### 5.1 Unpacking and incoming inspection

Unpack the equipment and remove all the packing materials and shipping cartons.

- The equipment must be inspected for damage after shipment. If damage has occurred during transit, all the shipping cartons and packing materials should be stored for further investigation. If the damage is visible a claim for shipping damage must be filed immediately.

To file a claim for shipping damage:

- The carrier must be informed within 7 days of receipt of the equipment.

The equipment must be checked against the packing list to verify that the shipment is complete.

The UPS is thoroughly inspected at the factory. If there are no damages or discrepancies, the installation may proceed.

Removing the equipment from the pallet (see figure 3):

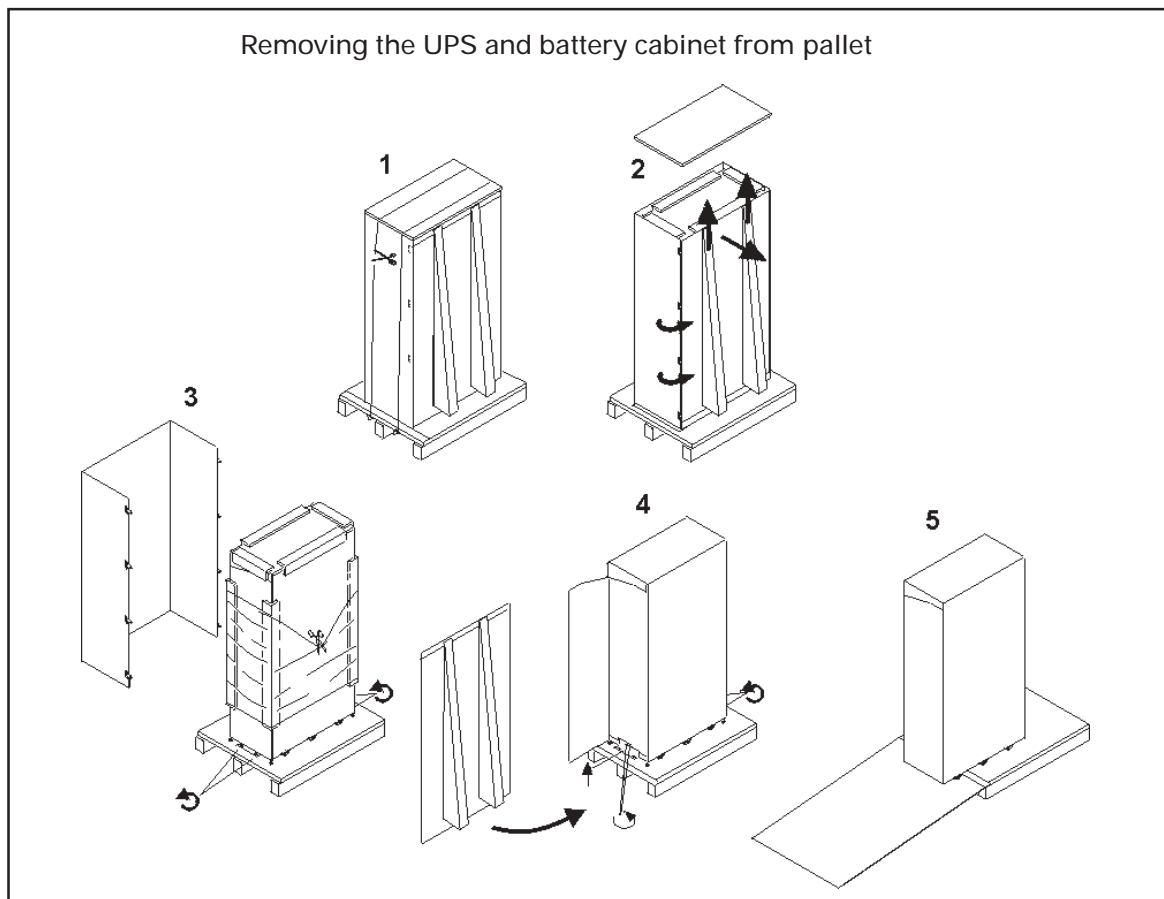


Figure 3. Unloading the UPS from pallet.

### 5.2 Moving

The UPS units are equipped with castors, for easy movement. The unit is simply pushed into place. Because the UPS is heavy, it should be verified that surfaces on which it is moved are strong enough. When wheeling the UPS, be careful not to tilt it.

## 6. Installation

### 6.1 Environment

All the requirements concerning environment described in this chapter (Installation) or chapter 11 (Technical specifications) must be met. If they are neglected the manufacturer cannot guarantee the safety of personnel during installation or use, or that the unit will function properly.

When locating the UPS system and the battery options, the following points have to be remembered:

- Avoid temperature and humidity extremes. To maximise the life time of the batteries, an ambient temperature of 15°C to 25°C is recommended.
- Provide shelter from the elements (especially moisture)
- Make sure that ventilation and space requirements are met. When the UPS is in use, there should be 10 mm clearance on the left side and 150 mm on the right side of 20-30 kVA UPS and 10 mm on the right side of 40-80 kVA UPS. 250 mm clearance is needed at the rear of the UPS and 500 mm on top of the UPS for ventilation, see figures 4a and 4b. 1000 mm clearance is needed in the front of the UPS for servicing.
- Maintain clearance at front of the UPS for service and user operations.
- The extra battery is preferred to be installed next to the UPS.

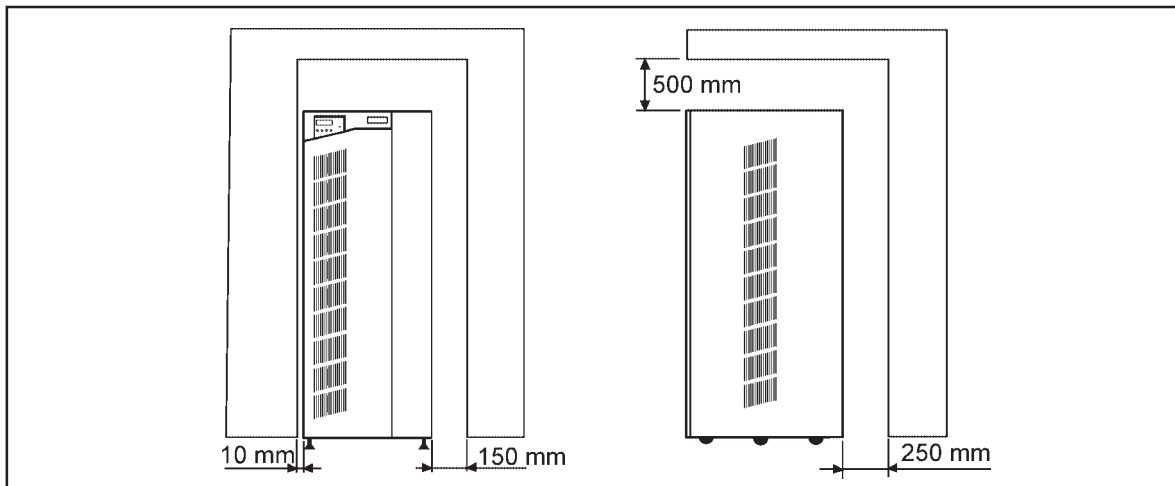


Figure 4a. Ventilation and space requirements for 20 - 30 kVA UPS.

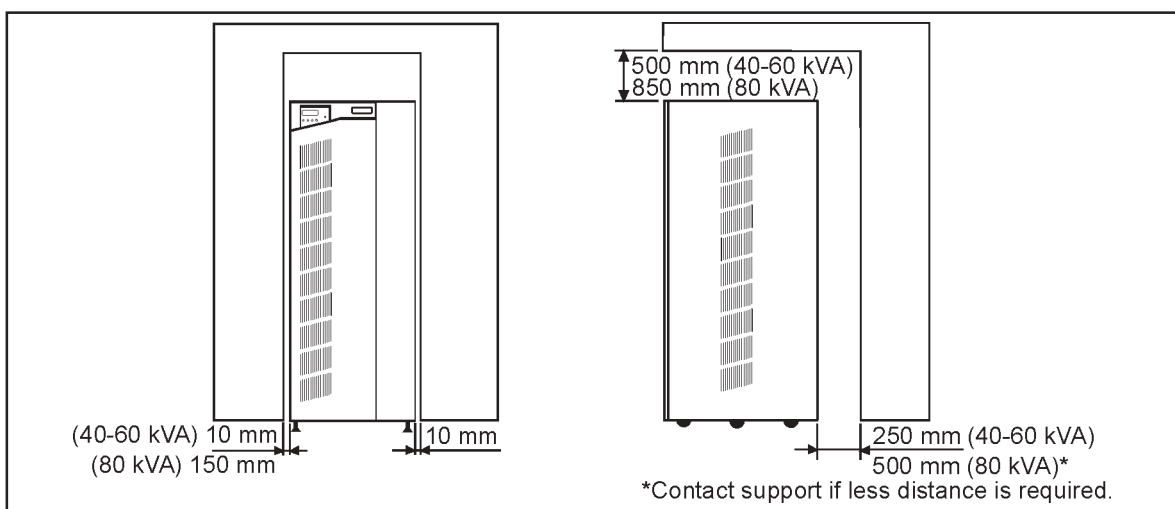


Figure 4b. Ventilation and space requirements for 40 - 80 kVA UPS.

## 6.2 Floor loading

When planning the installation the floor loading must be taken into consideration because of the heavy weight of the UPS and battery cabinets.

The strength of the installation surface must be adequate for point and distributed loadings given in table 2.

UPS modules	Weight (kg)	Point loading (kg/cm <sup>2</sup> )	Distributed loading (kg/m <sup>2</sup> )
UPS 20-30 kVA + with internal batteries	490(400)	7.2(5.9)	1550(1265)
UPS 20-30 kVA w/o batteries	210	3.1	520
UPS 40 kVA w/o batteries	230	3.6	565
UPS 50-60 kVA w/o batteries	260	4.0	635
UPS 80 kVA w/o batteries	280	4.3	680
Battery modules	Weight (kg)	Point loading (kg/cm <sup>2</sup> )	Distributed loading (kg/m <sup>2</sup> )
Bat D	550	8.1	1830
Bat E	815	12.0	1990
Bat F	1390	10.4	1705

Table 2. The UPS floor loading of UPS modules and battery cabinets.  
The numbers indicated in parentheses are for 20 kVA units with battery banks of 32 pcs battery system.

## 6.3 Installing 20 - 30 kVA UPS and battery cabinets

When installing external battery cabinets to the UPS, which includes the internal battery bank, an additional circuit breaker is needed for the battery connection. The circuit breaker will not be included in the external battery cabinet and the circuit breaker has to be ordered separately. Only one circuit breaker is needed per one UPS no matter how many external battery cabinets are connected.

The circuit breaker (F4) will be installed inside the UPS on the right side of the input/output terminals. See figure 7.

The circuit breaker will include four-part plug that has to be connected to the plugs X8-X9 beside the rectifier input terminals. See figure 7.



**WARNING!**

**Battery plugs X8-X9 are connected direct to the internal battery bank and contain high DC-voltage.**

Connect the plugs X8-X9 of the breaker to the plugs X8-X9 of UPS.

Cables from the battery cabinet will be connected straight to the circuit breaker. See figures 5b and 5c.

If the UPS is without the internal battery bank, the circuit breaker F4 is not needed. The cables of the external battery bank can be connected direct the battery breaker F2. Before connecting the cables of external battery cabinet to F2 remove the cables which are assembled at F2 from below. See figures 5b and 5c.

If external battery cabinets are installed, it is located next to UPS and on the left side of the UPS. Remember to leave 10 mm space between the cabinets. On the right side of UPS is needed 150 mm space. See figure 5a.

Each battery cabinet has temperature measurement and the cable from battery cabinet has to be connected to terminal X6 (male) beside the input/output terminals. See figure 7. Cable routing is under the cabinets. When several external cabinets are used the temperature information from battery cabinets has to be linked together. See figures 5b and 5c. The temperature sensor is located under the roof of the battery cabinet.

Cabling between UPS and battery cabinet is done through the cable entries in the bottom of the cabinets. Take care that the battery cables which are outside the UPS and the external battery cabinet are protected with the casing tube. If connecting several D and E battery cabinets the cabinet connections should be according figure 5b. Battery connections with battery cabinet F should be done according figure 5c.

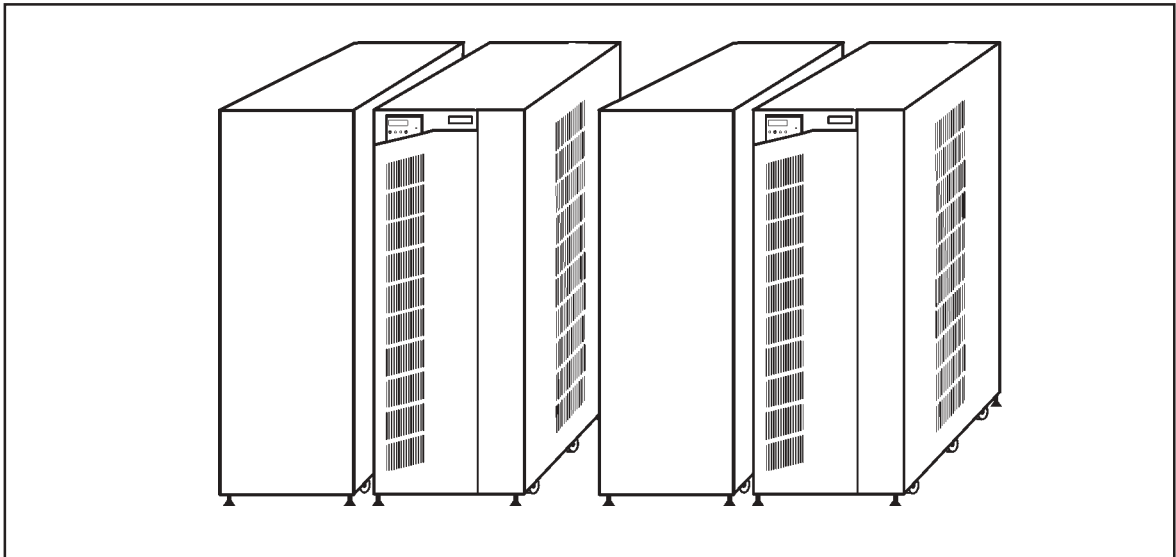


Figure 5a. Locating 20 - 30 kVA UPS modules and battery cabinets.

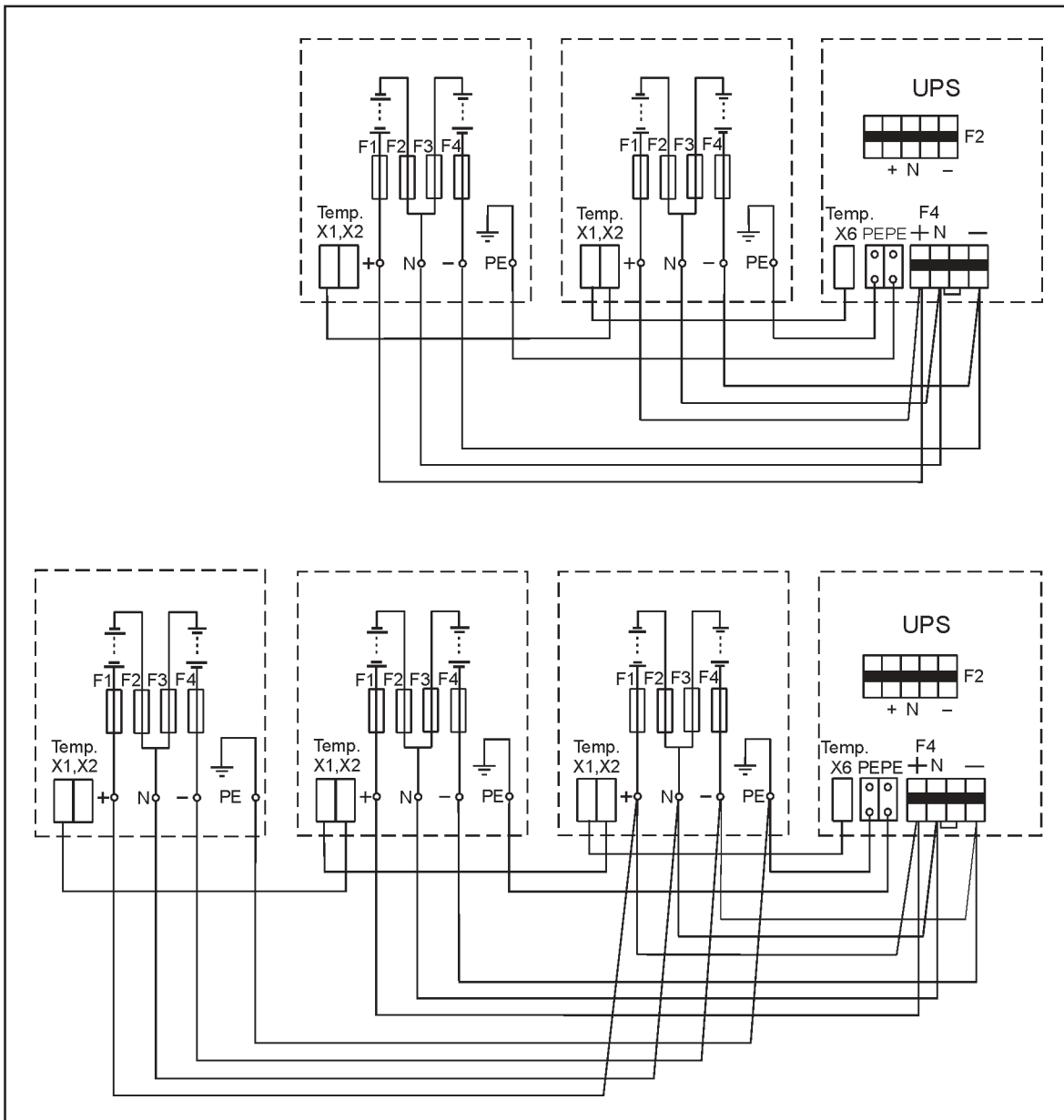


Figure 5b. Connecting battery cabinets D and E to the 20-30 kVA UPS.

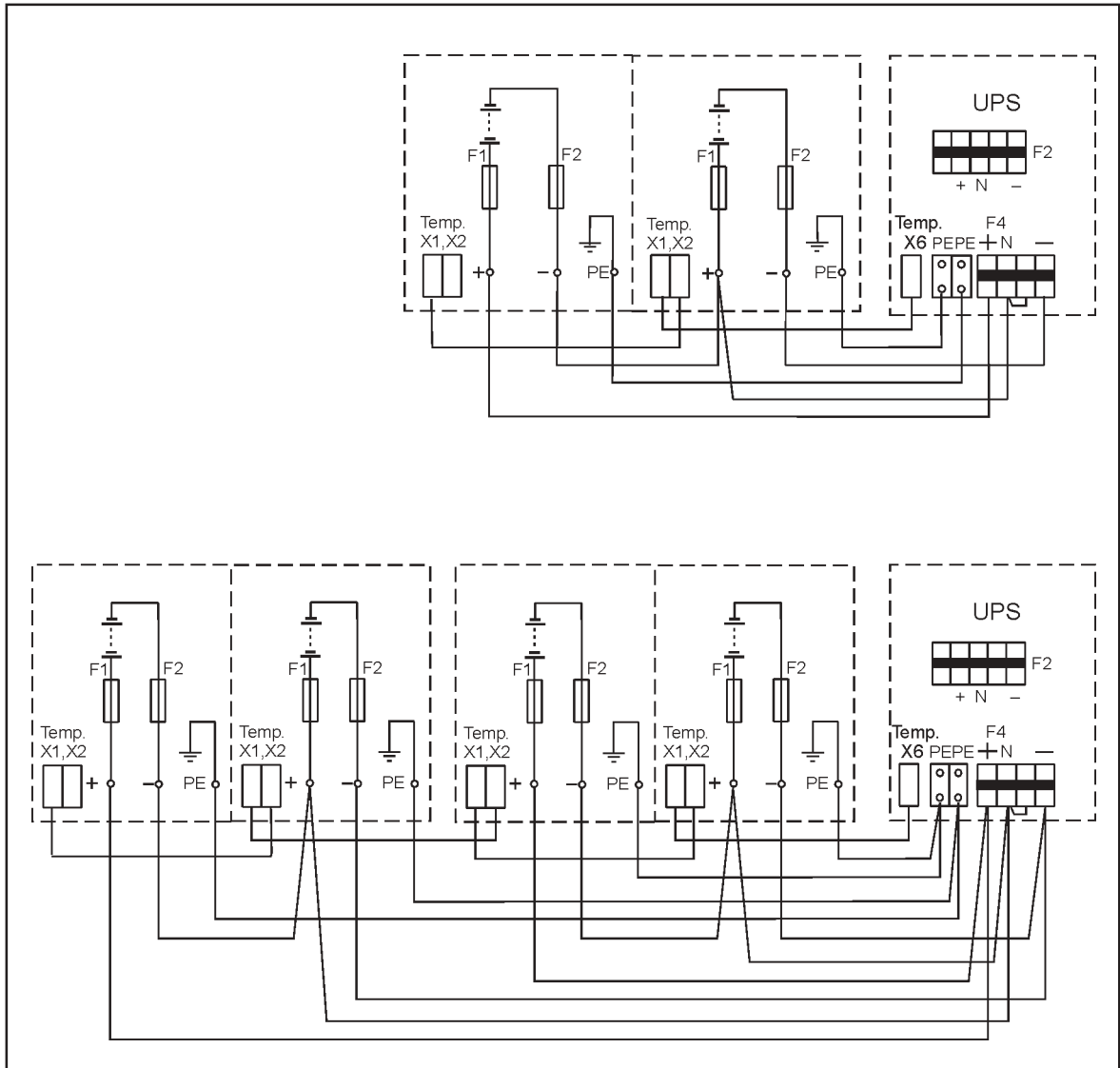


Figure 5c. Connecting battery cabinet F to the 20-30 kVA UPS.

## 6.4 Installing 40 - 80 kVA UPS and battery cabinets

External battery cabinets should be installed on the left side of the UPS. The cabinets should be bolted together by using the metal plates provided with external battery cabinets. See figure 6a.

Before connecting UPS and battery cabinets together the left side plate of the battery cabinet have to be removed. Do not remove the UPS cabinet side plates.

When connecting battery cabinets together with the connection plates delivered with battery cabinets (figure 6a) remove both side plates between the cabinets.

Each battery cabinet has temperature measurement and the cable from battery cabinet has to be connected to terminal X6 (male) beside the input/output terminals. See figure 8. Cable routing is under the cabinets. When several external cabinets are used the temperature information from battery cabinets has to be linked together. See figures 6b and 6c. The temperature sensor is located under the roof of the battery cabinet.

Cabling between UPS and battery cabinet is done through lower part of UPS right side. If connecting several D and E battery cabinets the cabinet connections should be according figure 6b. Battery connections with battery cabinet F should be done according figure 6c.

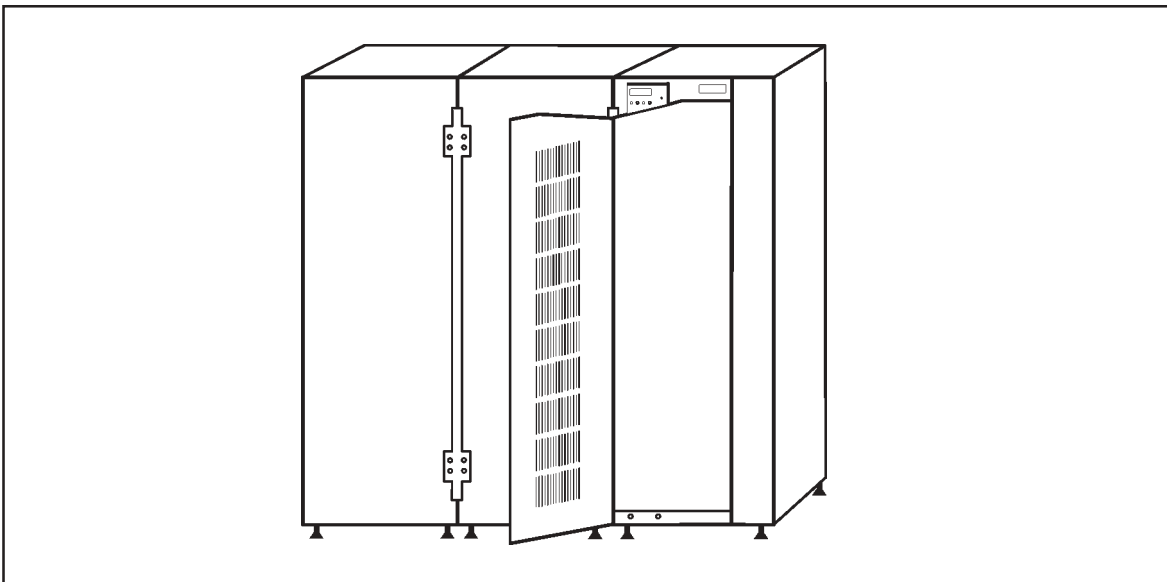


Figure 6a. Connecting battery cabinet to 40-80 kVA UPS module. (Right side panels of battery cabinets disconnected)



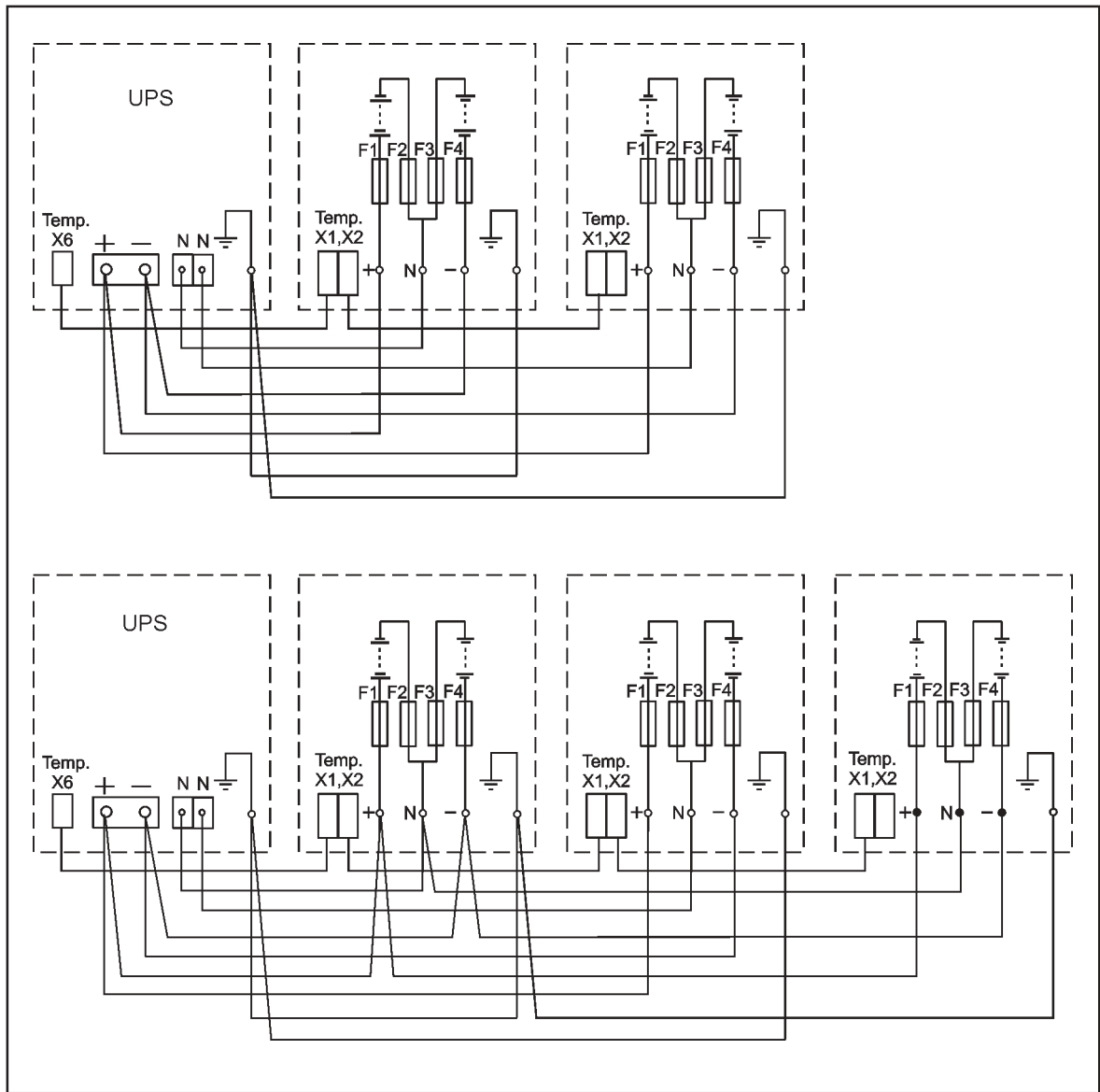


Figure 6b. Connecting battery cabinets D and E to 40-60 kVA UPS.

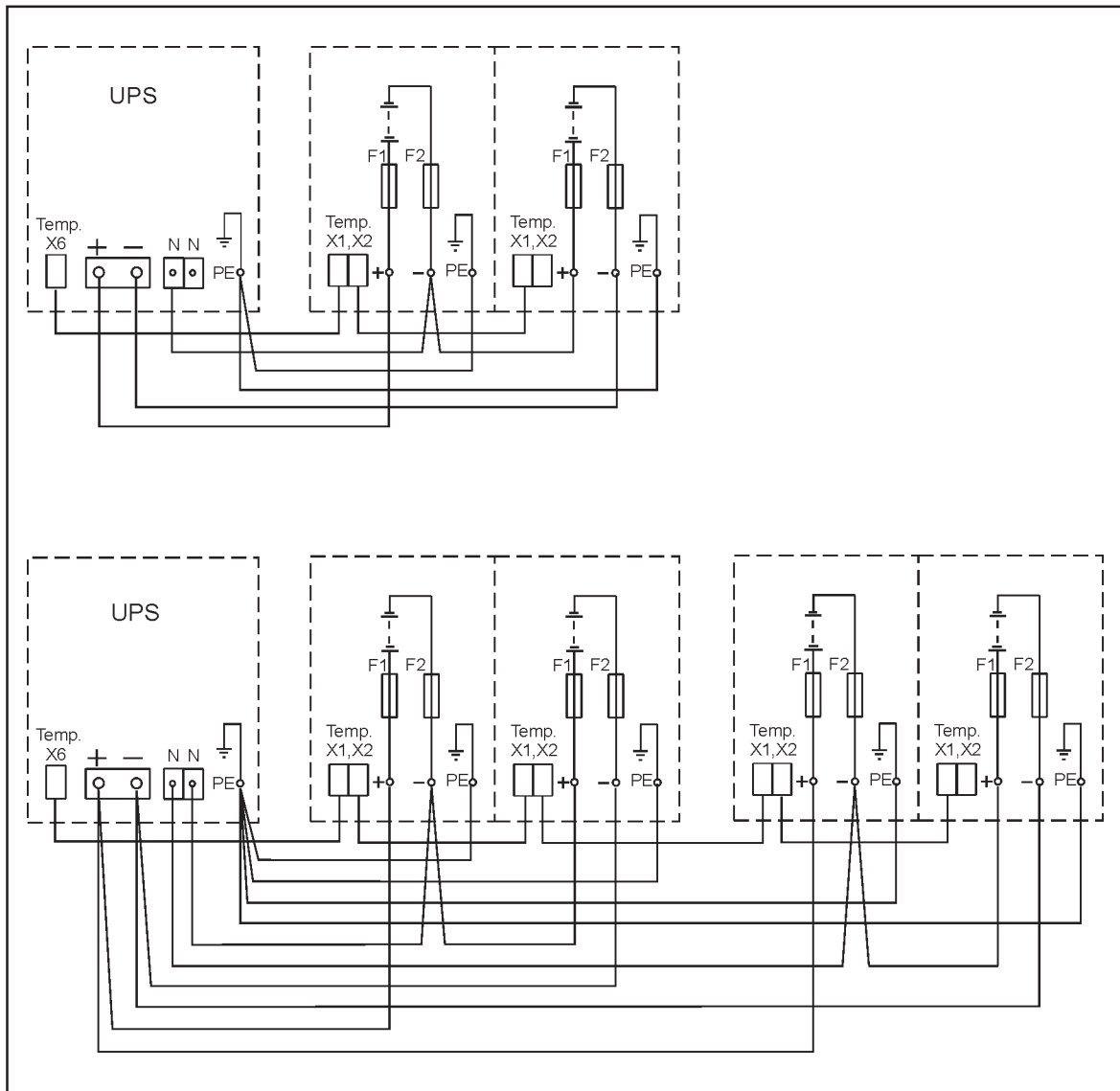


Figure 6c. Connecting battery cabinet F to 40-80 kVA UPS.

## 6.5 Power connections

The electrical planning and the UPS installation must be done by qualified personnel only.



**WARNING!**

**The UPS contains high voltage and current which can injure or kill personnel and damage equipment.**

The customer has to supply the wiring to connect the UPS to power lines.

The installation inspection and initial start up of the UPS and extra battery cabinet must be carried out by service engineer from the manufacturer or from an agent authorised by the manufacturer.

The UPS unit has the following power connections:

- 3-phase and N and  $\oplus$  connection for rectifier input
- 3-phase and N and  $\oplus$  connection for bypass input
- 3-phase and N and  $\oplus$  connection for load output
- +, -, N and PE connection for external batteries

All input and output wiring of the UPS connects to the terminals located behind the cover plate behind the door and the front panel. Wiring can be routed through the cable entry at the bottom or back of the UPS cabinet.

The UPS is provided with a single phase 230 V power supply for use with internal modem or portable computer. Connection is at terminal X5. This power supply is protected with an automatic 10 A fuse F3. See figure 7 or figure 8 according to UPS power.

The UPS is provided with temperature sensor connections for the optional isolation transformer and input filter. Terminal X7 is for the transformer and terminal X12 is for the input filter. These terminals are located beside the input/output terminals. See figure 7 or 8. For more information see the installation instruction of the transformer or input filter option.

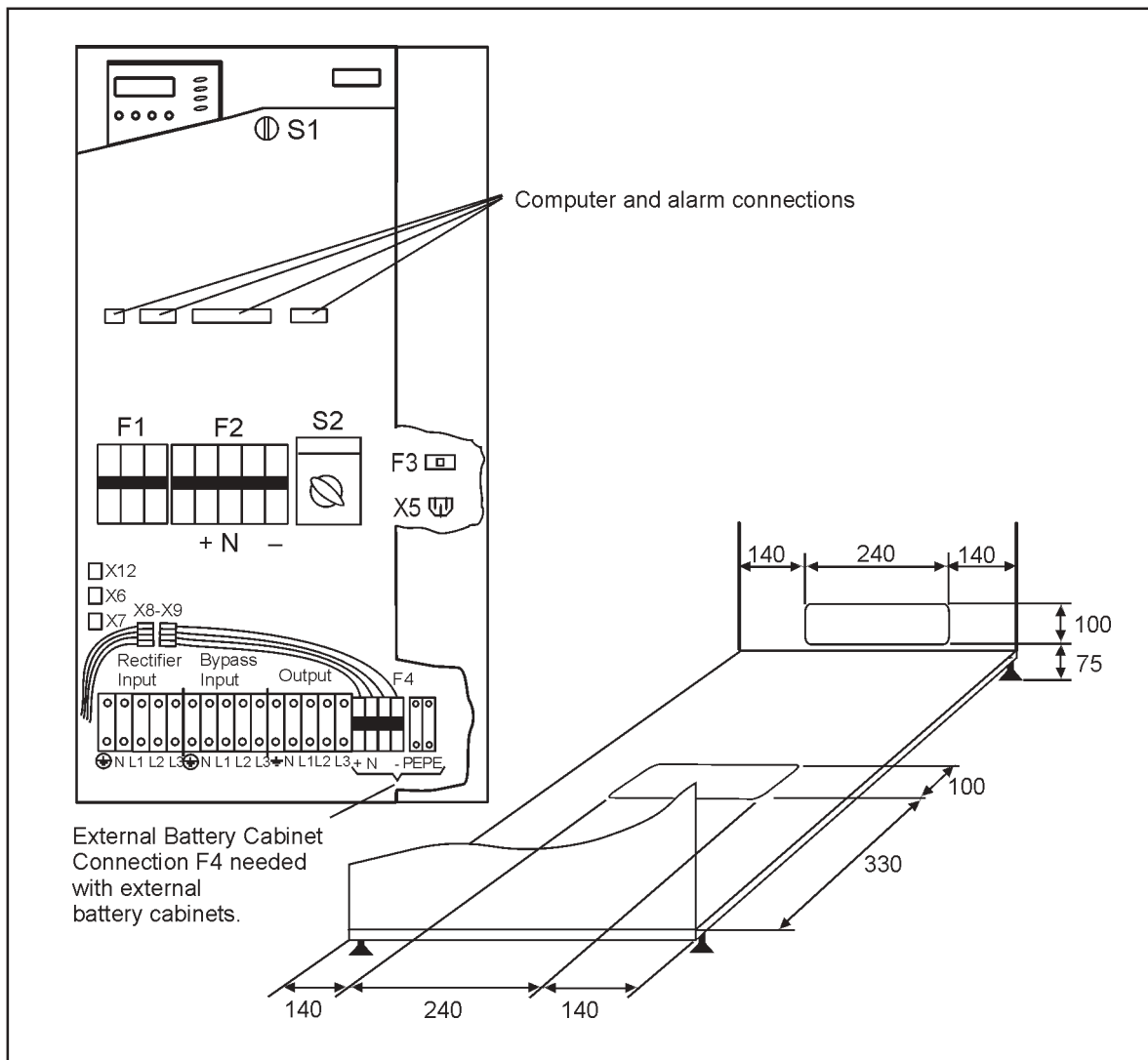


Figure 7. 20-30 kVA UPS connection locations

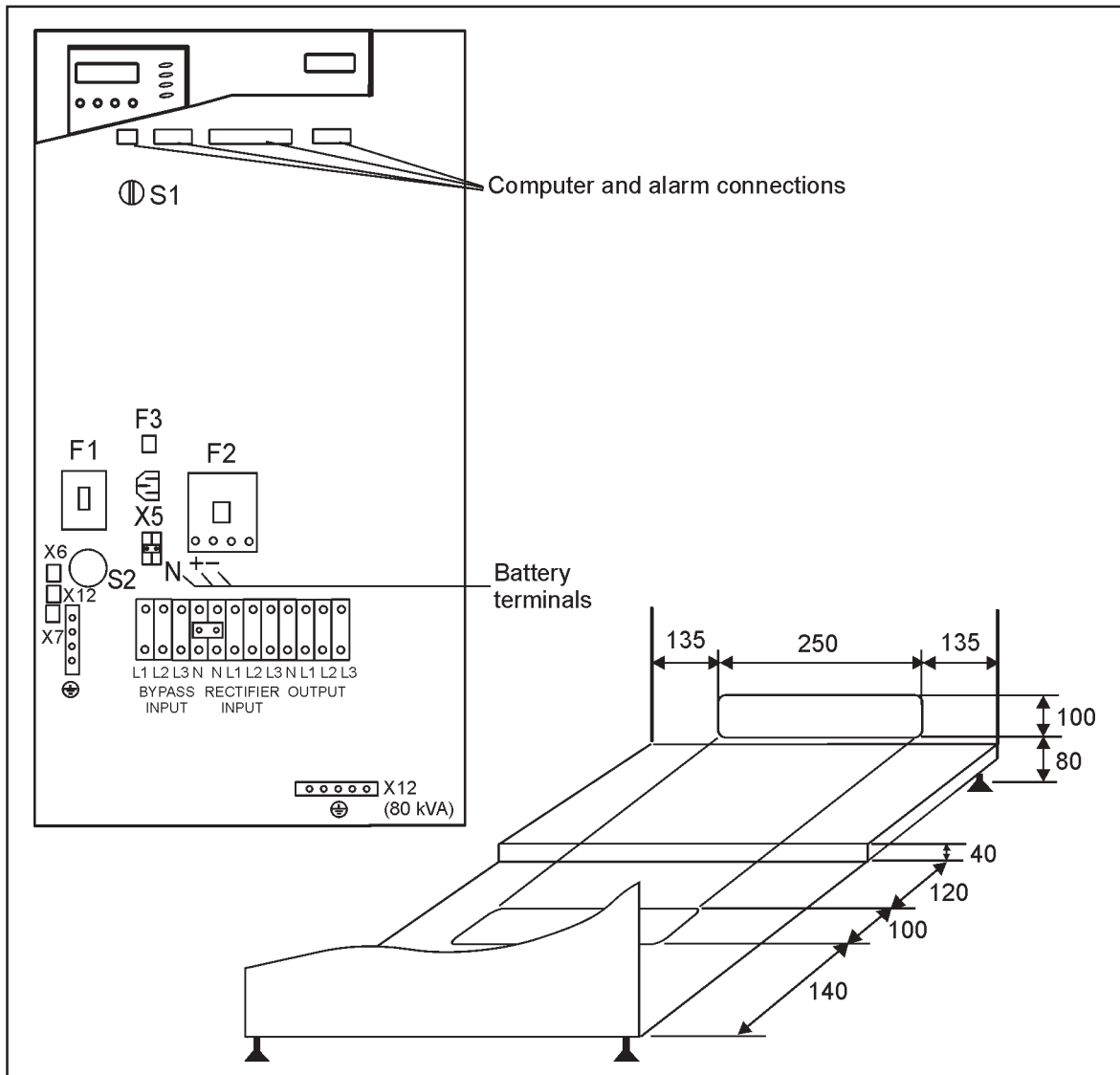


Figure 8. 40-80 kVA UPS connection locations and cable routings

## Mains and load connections

The proper connection order is as follows:

1. Check that electrical connections to the installation site have been properly executed. Also check fuse or circuit breaker ratings and cable dimensions against figure 9 for 20-30 kVA systems and figure 10 for 40-80 kVA systems.
2. A readily accessible disconnect device must be incorporated in the fixed wiring. The disconnect device shall have a contact separation of at least 3 mm.

Since the UPS does not have automatic backfeed isolation a warning label must be added on all primary power isolators installed remote from the UPS area to warn electrical maintenance personnel that the circuit feeds a UPS.

The warning label shall carry the following wording or equivalent:

ISOLATE UNINTERRUPTIBLE POWER SYSTEM (UPS) BEFORE WORKING ON THIS CIRCUIT.

3. Switch off the supply to the distribution point to which the UPS unit is to be connected.
4. For extra safety, also remove the fuses from the selected lines.  
**Make absolutely sure that there is no power.**
5. The UPS should be connected in accordance with figures 9 - 10 according to the UPS power.
6. If two cable installation is considered, the interconnection wires between the rectifier and the bypass input terminals must be removed.
7. Connect input cables and output cables to the UPS.  
Note: Make sure that the neutral of the bypass input is properly connected.
8. Make sure that the UPS unit output cable is connected to the load.
9. Also connect the computer and alarm connections according chapter 7.  
These connections are behind the door.
10. If an external bypass switch will be used, contact your dealer first.

The UPS unit is now connected to the mains and to the load but there is no power.  
**Make sure that the connections are properly made.**

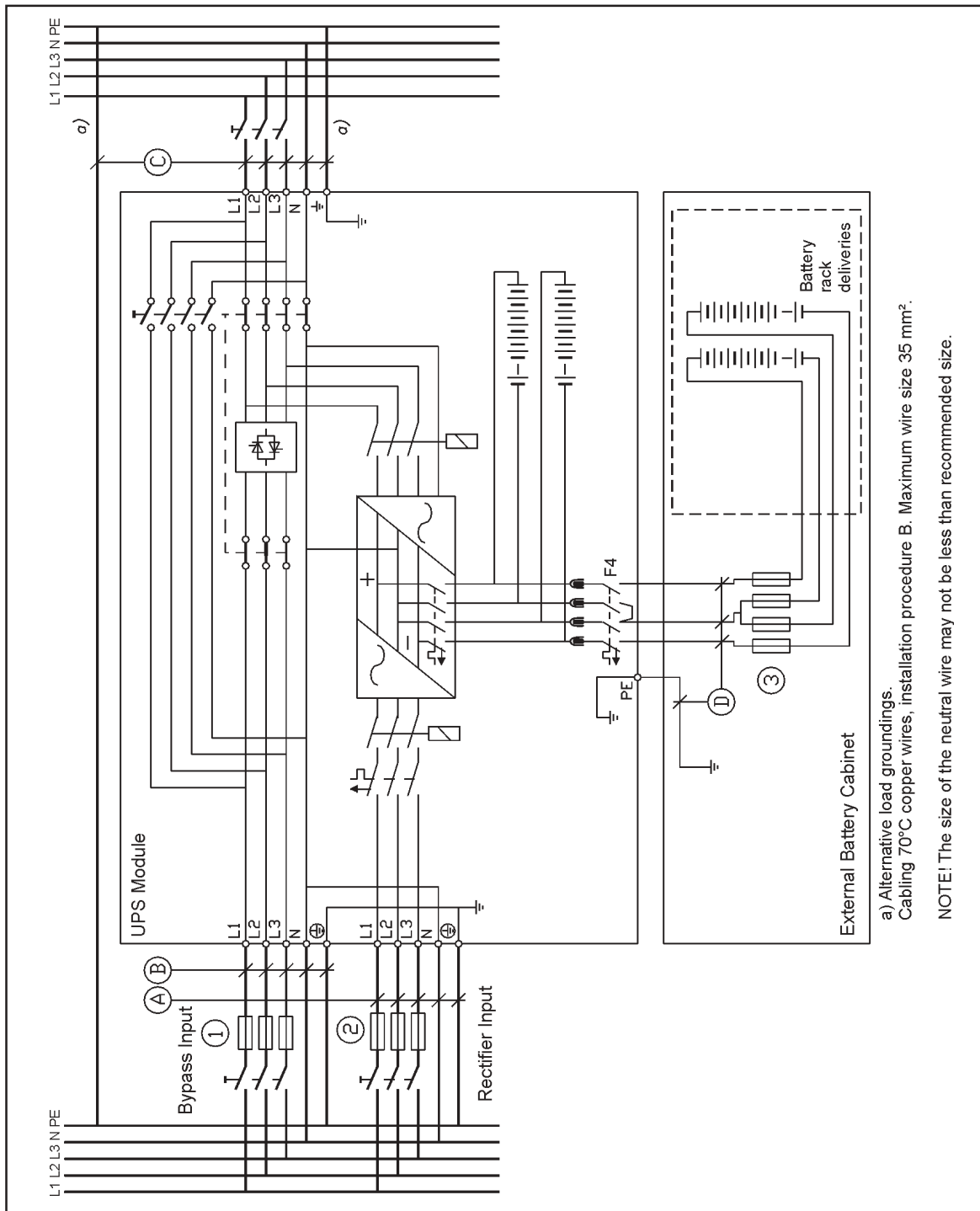


Figure 9. Five-wire installation of UPS units from 20 to 30 kVA with two-cable input.

Power	Fuse 1	Fuse 2	Fuse 3	Cable A	Cable B	Cable C	Cable D*
20 kVA	35 A	35 A	100 A	10 mm²	10 mm²	10 mm²	16 mm²
30 kVA	50 A	50 A	100 A	10 mm²	10 mm²	10 mm²	16mm²

Table 3. Fuse and cable dimensions for five wire installations of UPS units from 20 to 30 kVA using two cable input. Note that the fuse numbers and the cable letters refer to the numbers/ letters in figure 9. Slow gG/gL fuses should be used to protect cables.

\*Please note that the battery cables are delivered with the external battery cabinets to install the external battery cabinet next to the UPS. Cables with higher current capacity are needed if the external battery cabinets or racks are installed with a distance from the UPS.

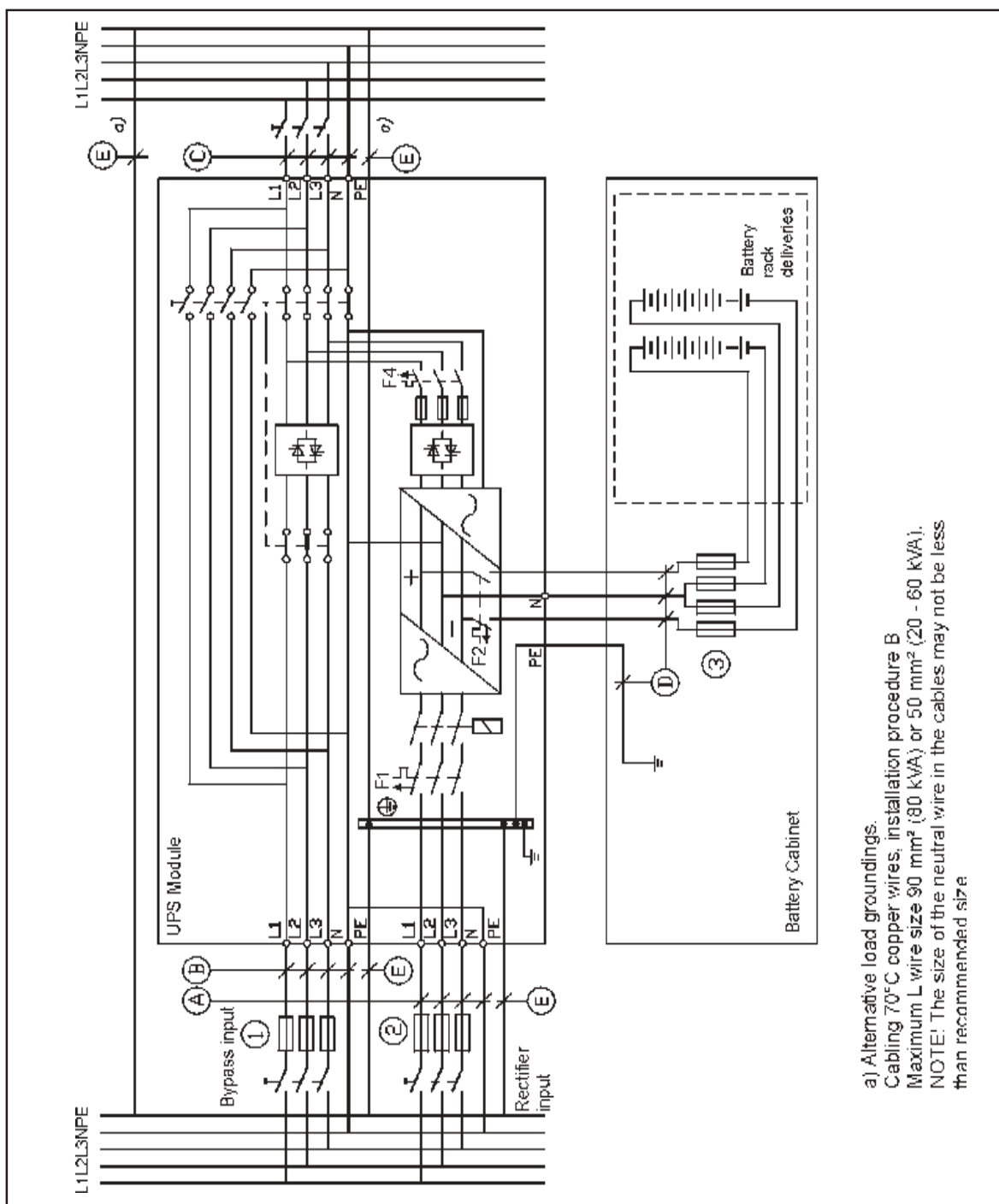


Figure 10. Five-wire installation of UPS units from 40 to 80 kVA with two-cable input.

Power	Fuse 1	Fuse 2	Fuse 3	Cable A	Cable B	Cable C	Cable D*	Cable E
40 kVA	63 A	63 A	100 A	16 mm²	16 mm²	16 mm²	16 mm²	16 mm²
50 kVA	80 A	80 A	100 A	25 mm²	25 mm²	25 mm²	16 mm²	25 mm²
60 kVA	100 A	100 A	100 A	35 mm²	35 mm²	35 mm²	16 mm²	25 mm²
80 kVA	125 A	125 A	125 A	50 mm²	50 mm²	50 mm²	16 mm²	25 mm²

Table 4. Fuse and cable dimensions for five-wire installations of UPS units from 40 to 80 kVA using two cable input. Note that the fuse numbers and the cable letters refer to the numbers/ letters in figure 10. Slow gG/gL fuses should be used to protect cables.

\*Please note that the battery cables are delivered with the external battery cabinets to install the external battery cabinet next to the UPS. Cables with higher current capacity are needed if the external battery cabinets or racks are installed with a distance from the UPS.

## 7. Computer and alarm connections

An interface for direct communication with your computer system is supplied in the UPS unit. The interface consists of two RS232 serial data interfaces, four potential free relays and four programmable inputs for building alarms. These interfaces are located behind the door. Communication cables connected to these terminals should be connected to cable holders on the cover plate behind the door and routing of these cables should be under the door (See figure 11).

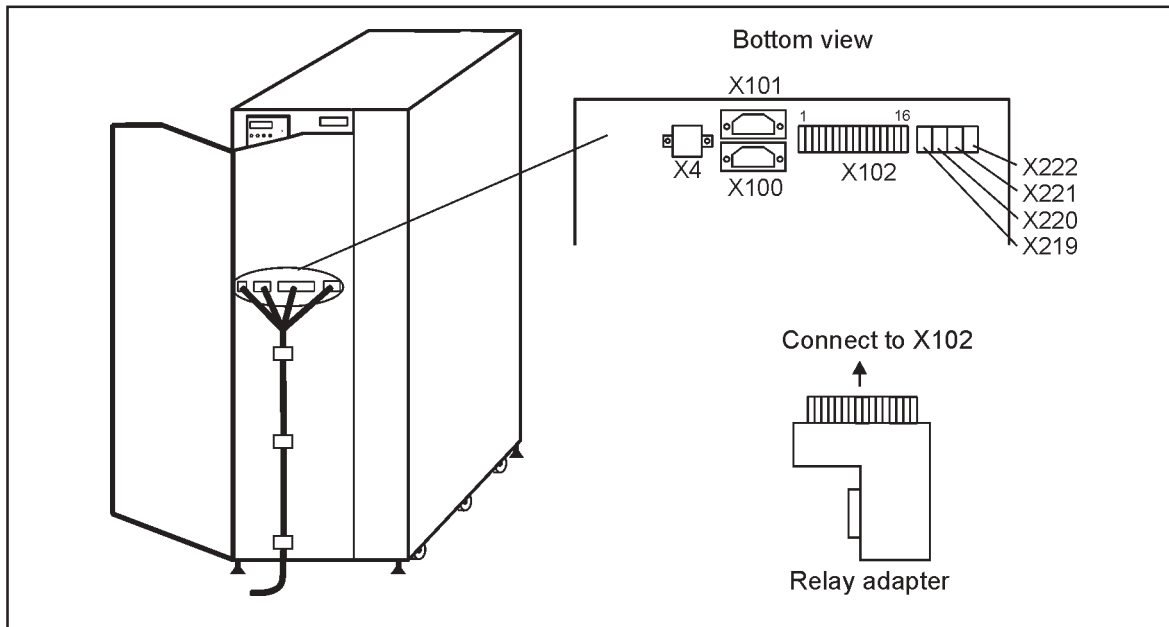


Figure 11a. Communication connections of 20-30 kVA UPS

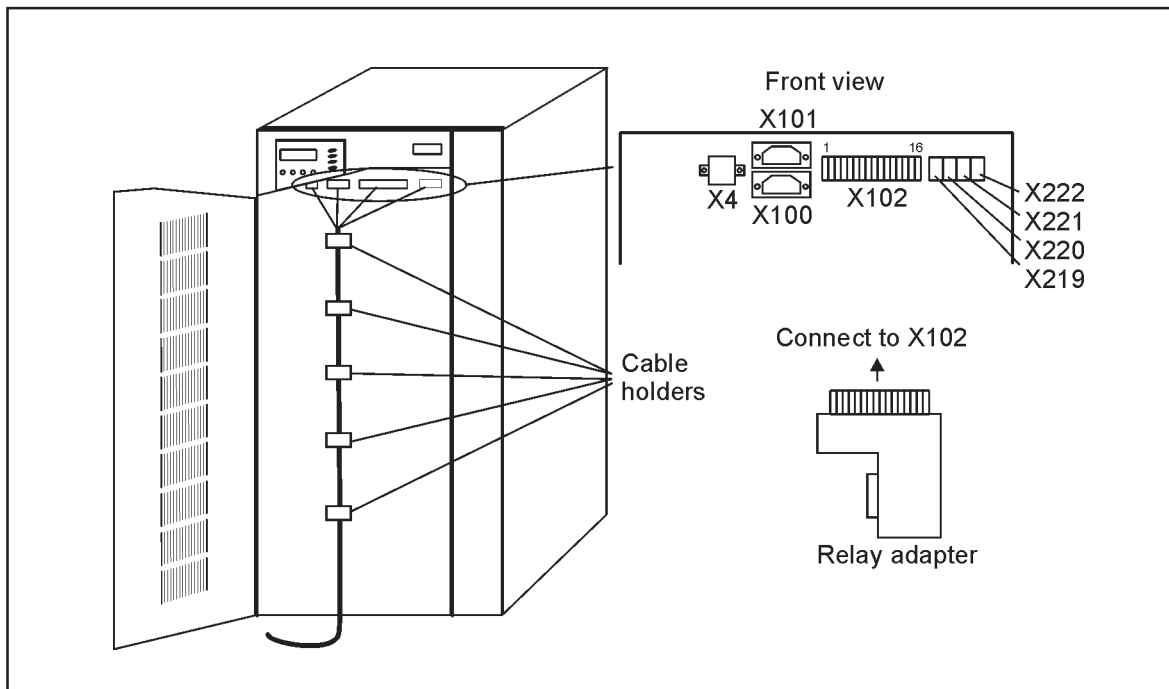


Figure 11b. Communication connections of 40-80 kVA UPS



The UPS is designed to fully comply with LanSafe III and PowerVision software. If any software not provided by the manufacturer is used, the pin configuration should be verified.

With the UPS is delivered a relay adapter circuit board which converts the 16 pin relay interface X102 to a 15-pin male D-sub terminal. See figure 11.

This adapter needs to be used when connecting options like Alarm Extension Unit to the UPS.



#### NOTE

**All connections mentioned in chapter 7 must not be galvanically connected to any mains connected circuits. Reinforced insulation to the mains is required.**

### Connecting the UPS to a computer

The UPS/PC communicating device is delivered as a complete solution package with accompanying Power Management Software. To connect the UPS to the computer, use the communication cable provided with the package. (Note: Do not use any other communication cable than the one provided with the UPS). Check from the software documentation that the platform running on your computer is supported. Follow the instructions of the Power Management Software to complete the installation. For other operating systems, SNMP and more advanced power protection solution combinations, please contact your local dealer.

### RS232 serial data interfaces

The RS232 interface X100 uses 9-pin female D-sub connector and the interface X101 is 9-pin male D-sub connector. The information includes data about the utility, load and the UPS itself. The connector X100 is to be used with a computer connection and the other X101 with a computer and a modem connection. See below the meaning of the pins. The RS232 must not be galvanically connected to any mains connected circuits. Reinforced insulation to the mains is required.

Pin 1	Received data
Pin 2	Transmitted data
Pin 4	Signal ground
Pin 8	DC output
Pin 9	UPS ground

Table 5. RS232 connection (X100) for the computer, 9-pin female D-sub.

Pin 1	Data carrier detected
Pin 2	Received data
Pin 3	Transmitted data
Pin 4	Data terminal ready
Pin 5	Signal ground
Pin 7	Ready to send

Table 6. RS232 connection (X101) for the computer, 9-pin male D-sub.

## Potential free relay interface

This relay interface consists of four potential free relays providing complete isolation between the UPS and the computer (X102, see figure 12).

The following information is available from these relays.

Pin 16 is the UPS shutdown input. User can send a high level for 5 seconds to turn off the UPS until proper voltage returns. It is active only when the UPS is in battery operation.

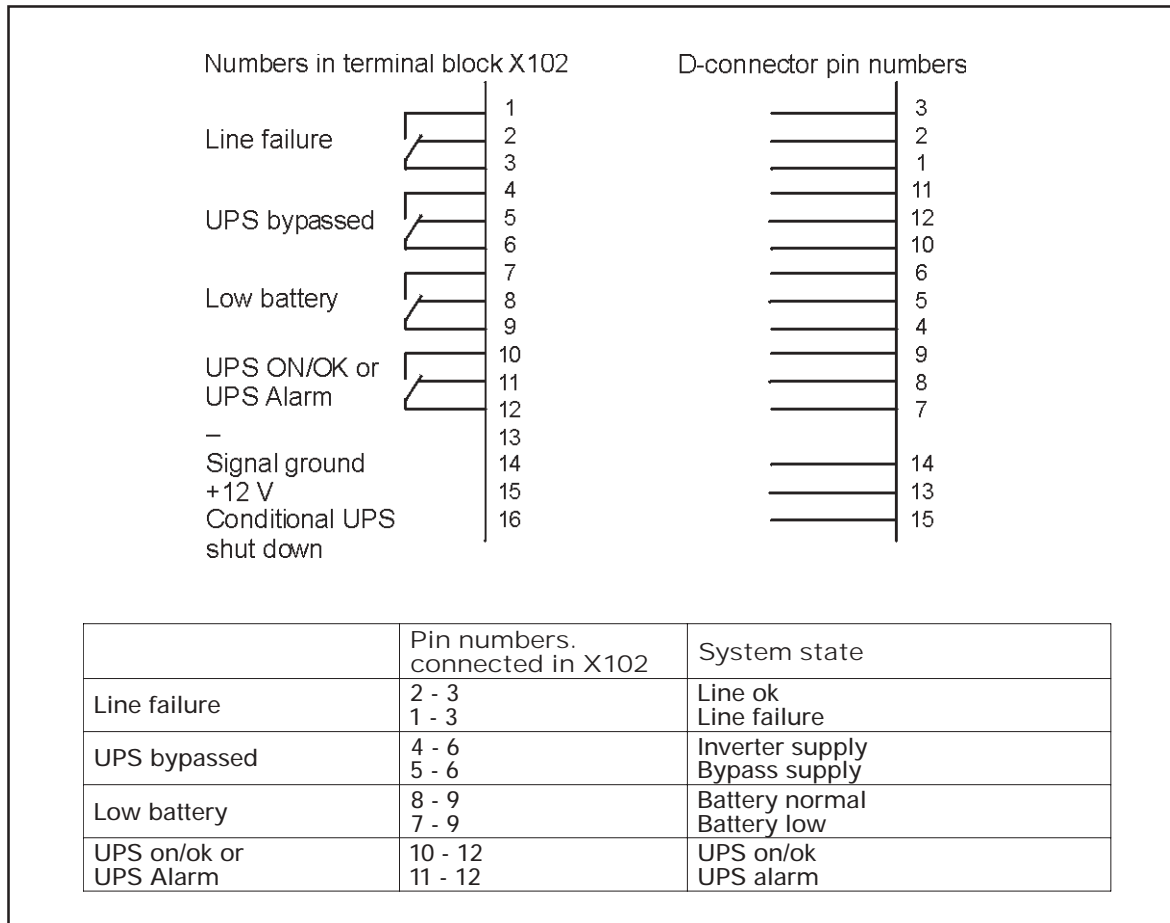


Figure 12. Relay interface of the UPS.

### NOTE!

The relay contacts are rated for maximum 1 A/30 Vac or 0,2 A/60 Vdc. All relay outputs are galvanically isolated from the other circuits of the UPS (UPS standards IEC 60950, EN 50091-1-1). The relay contacts must not be galvanically connected to any mains connected circuits. Reinforced insulation to the mains is required.

## Emergency Power Off Input

This input is used to shut down the UPS from a distance. This feature can be used for emergency power down, or for shutting down the load and the UPS by thermal relay for instance in the event of room overtemperature. Remote shut down wires are connected on connector X4 (see figure 11).

The pins of connector X4 have been connected together. When this connection is open, the logic circuitry will immediately shut down the UPS, thus preventing the power from supplying the load. In order to have the UPS running again the pins of connector X4 have to be connected and the UPS manually started. The pins must be shorted in order to keep the UPS running. Maximum resistance is 10 ohm. The EPO must not be galvanically connected to any mains connected circuits. Reinforced insulation to the mains is required.

## Programmable Inputs

The UPS communication device includes four programmable inputs (X219, X220, X221, X222) for building alarms. These inputs can be for example informing when UPS gets power from generator, shutting down and starting up inverter remotely or turning to bypass mode remotely. These inputs can be activated by connecting the two pins together of the particular terminal.

These programmable inputs have the following default values:

### Generator On Input X219

The generator on input is used for inhibiting the transfer to static bypass line when the UPS is supplied by an unstable ac source.

The generator auxiliary contact wires are connected on terminal X219 (see figure 11). In normal operations the pins of X219 are not be connected together. When the connection between these pins are connected together by floating contacts of the generator control device, the logic circuitry in the UPS will prevent the transfer to unstable power source. When the unit is delivered the connection on terminal X219 will be open.

### Remote Output On/Off Input X220

The remote output on/off input is used to turn off the output of the UPS from a distance. Remote output on/off wires are connected on terminal X220 (see figure 11).

The pins of connector X220 are not to be connected together in normal operation. When the connection between these pins are connected together by floating contact the inverter will be turned off and also the static bypass line will be turned off. In order to turn on the inverter and the static bypass line the connection between these pins have to be opened.

### External Bypass Switch Input X221

If the UPS system is equipped with an external bypass switch, its status can be monitored by the UPS via terminal X221. The external bypass switch auxiliary contact wires are connected on terminal X221 (see figure 11).

If an external bypass switch will be used, contact your dealer first.

### Environment Alarm Input X222

The environment alarm input is used for connecting the UPS to your building alarms, such as overtemperature or smoke detector alarms.

The environment alarm input contact wires are connected on terminal X222 (see figure 11). When this alarm is activated it will be indicated to the user through RS232 ports.

#### NOTE!

The programmable auxiliary inputs (Generator ON, External Bypass Switch, Remote Output On/Off, Environment Alarm) must not be galvanically connected to any mains connected circuits. Reinforced insulation to the mains is required for equipments and cables connected to these connections.

## 8. User's guide to operations

This chapter contains the necessary information on how to use the UPS. The starting up and shutting down procedures described here are only used on a few occasions for example when preparing for a long term mains failure or changing the batteries. In normal operation the UPS runs automatically.

Initial start up is always performed by a service engineer of the manufacturer or by a representative of an agent authorised by the manufacturer. Otherwise the safety of personnel during installation or use, or that the unit will function properly, can not be guaranteed.

During commissioning the manufacturer representative will train the users to operate the UPS system.



### 8.1 Starting up the UPS

Make sure that UPS installation has been carried out correctly and line, neutral and protective earth inputs have been connected. Figures 7 and 8 show the location of the switches and breakers. The UPS is also provided with a battery start up possibility. When the following start up is done the UPS will also start up if the input power line is not available or acceptable. In this case the UPS will be in battery mode supplying power from the battery bank.

#### 8.1.1 Starting up 20 - 30 kVA UPS

- Open the door of UPS.
- Check that S1 is in off position
- Check that the maintenance bypass switch S2 is Bypass ON position.  
(In the battery start up the maintenance bypass switch has to be in Bypass OFF position.)
- Turn the circuit breakers F1 and F2 (and F4 if installed) to ON-position
- Start the UPS by turning the main switch S1 to "On" position

The UPS will now check its internal functions. The UPS starts after 10 - 30 s.

- Check that the green  and yellow  are lit.
- Turn the maintenance bypass switch S2 to Bypass OFF-position. (Not needed in the battery start up.)
- Close the door.

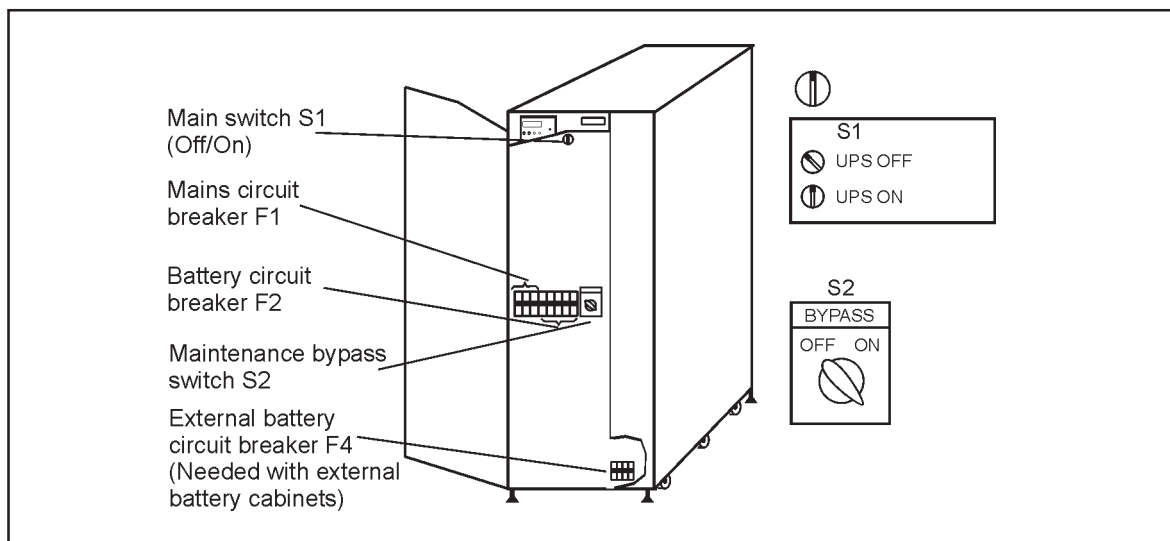




Figure 13a. Starting up and shutting down switches of 20-30 kVA UPS. (Front door opened.)

### 8.1.2 Starting up 40 - 80 kVA UPS

- Open the door of UPS.
- Check that S1 is in UPS OFF position.
- Check that the maintenance bypass switch S2 is BYPASS ON position.  
(In the battery start up the maintenance bypass switch has to be in Bypass OFF position.)
- Turn the circuit breakers F1 and F2 to ON-position.
- Start the UPS by turning the main switch S1 to “UPS ON” position.

The UPS will now check its internal functions, synchronise to mains and start supplying power to the output. The UPS starts after 10 - 30 s.

- Check that the green  and yellow  are lit.
- If the maintenance bypass switch S2 is in BYPASS position turn it to UPS position.
- Close the door.

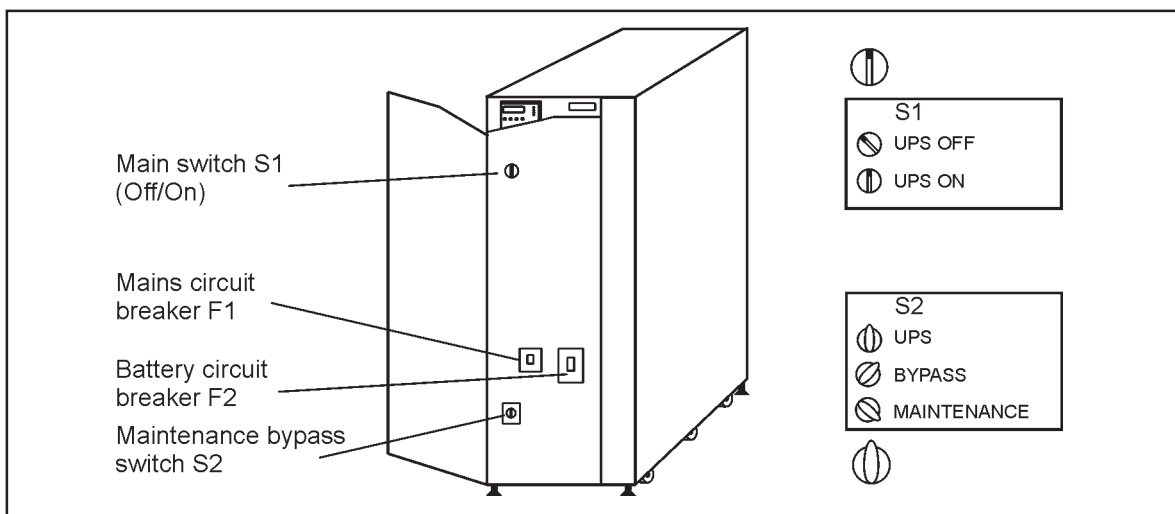




Figure 13b. Starting up and shutting down switches of 40-80 kVA UPS.

### 8.2 Shutting down the UPS

The UPS unit does not have to be shut down at the end of each day. The unit is designed to cope with a continuous load from the day it is installed until a change is needed in the backup battery bank.

Shutting down procedure:

- Check from the display that the unsynchronised alarm is not active.  
Press “Menu” button and see the UPS status by pressing  and .
- Open the door of UPS.
- Turn the maintenance bypass switch S2 to the BYPASS position.
- Turn the main switch S1 to UPS OFF position.
- Turn the circuit breakers F2 and F1 to OFF position (and F4 in 20-30 kVA UPS if installed).
- The UPS stops supplying power and it will be disconnected internally from the batteries.

#### NOTE!

The load receives its power directly from the power line through the maintenance bypass switch. High voltage is still present in some parts of the UPS. DC fans might be running after shutdown procedure due to capacitors.

## 8.3 Control panel functions

The monitor panel shows the status of UPS operation with four LED indicators and with a LCD screen. The display also generates audible alarm if the user should be alerted.



This green LED is lit when there is voltage at the output terminals and when the UPS is in normal or static bypass mode.



This yellow LED is lit when the UPS is operating in battery mode. When this LED is blinking the battery voltage is low and only few minutes of backup time is left.



This yellow LED is lit when the UPS is on and is operating in bypass mode.



This red LED is lit when a situation in the UPS requires immediate action.

The LCD screen informs the user the status and type of the UPS, measurements of performance and the alarms.

Operation of the display can be controlled with the push buttons under the display. With MENU-button you get to the menu and with the ↓ and ↑ arrows you can move through the options in the menu and with ↵ button you can select the function and move to submenu.

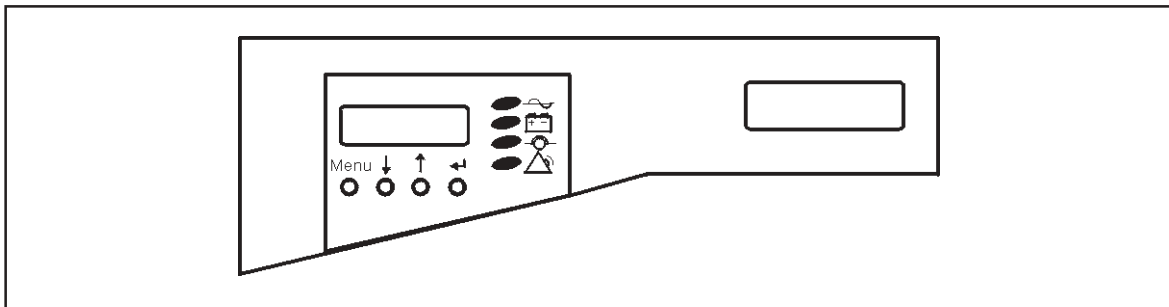


Figure 14. Control panel

### 8.3.1 Normal display

The Normal display shows the UPS type. The panel automatically returns to this display state from any other display state after a delay time of 1 to 2 minutes from last display state change.

### 8.3.2 Menu display

The following display choices can be selected in the Menu display by scrolling through menu with ↓ and ↑ buttons and pressing ↵ button:

- UPS Status
- Meters
- Battery Status
- Alarm log
- UPS parameters
- UPS Identification
- Reset Button
- Display Data

If Menu button is pressed the panel will return to Normal display.

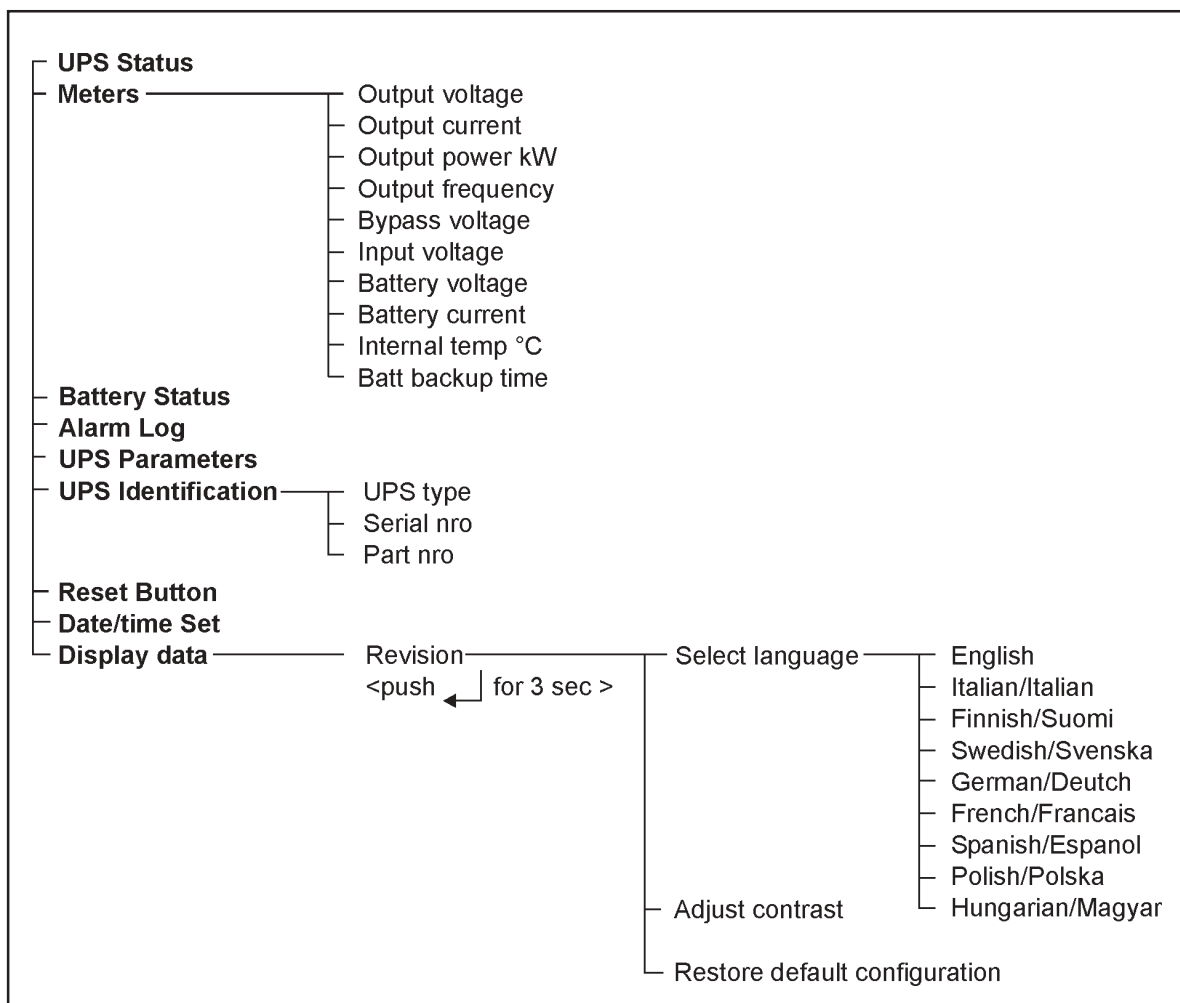


Fig 15. Menu map

#### 8.3.2.1 UPS Status display

UPS Status display will indicate the current operation mode of the UPS on the top row of the display. The display will automatically come to this display state if there is some abnormal operation in the unit. If there is active alarm in the unit it will be indicated on the bottom row. Pressing ↓ button will transfer the display to Active Alarms display. Here all the active alarms can be scrolled through with the ↓ button and return to UPS Status display can be made with ↑ button.

When an active alarm appears on the display also an audible alarm is generated. This audible alarm can be silenced by pressing any button.

Pressing Menu button will return the display to Menu display.

#### 8.3.2.2 Meters display

The Meters display will inform various measurements of the UPS. Different measurements can be selected with ↓ and ↑ buttons. Following measurement information is available:

- Output voltage, shows AC voltage of each output phase
- Output current, shows current of each output phase
- Output power, shows power in kW of each output phase
- Output frequency, unit is Hz
- Bypass voltage, shows bypass line voltages of each phase
- Input voltage, shows rectifier input line voltages of each phase
- Battery voltage, shows DC voltage of both positive and negative battery string
- Battery current, shows battery current of both positive and negative battery string
- Internal temp, shows temperature inside the UPS, unit is °C.
- Batt backup time, shows the battery backup time in minutes. If backup time is more than 90 minutes the display shows 9999.

Pressing Menu button will return the display to Menu display.

#### 8.3.2.3 Battery Status display

The Battery Status display informs in what mode of operation the ABM (Advanced Battery Management) is.

Pressing Menu button will return the display to Menu display.

#### 8.3.2.4 Alarm Log display

The Alarm Log display will indicate the 8 latest alarms of the UPS and also the time when each alarm has happened. The time shown (days hrs:min:sec) is the time between consecutive alarms. The alarms can be viewed by pressing the ↓ button. Pressing Menu button will return the display to Menu display.

#### 8.3.2.5 UPS parameters display

The UPS Parameters display will inform the values of the operational parameters of the UPS. These parameters are to be changed only by service personnel of the manufacturer or by a representative of an agent authorised by the manufacturer. The parameter value changes are password protected.

The values of different parameters can be viewed by the ↓ and ↑ buttons. The display will indicate first the parameter number (Pxx) and after that the value of the parameter (Vyy). Pressing Menu button will return the display to Menu display.



#### 8.3.2.6 UPS Identification display

This display informs the UPS type, unit serial number and unit part number. These options can be scrolled through ↓ and ↑ buttons.

Pressing Menu button will return the display to Menu display.

#### 8.3.2.7 Reset button

Selecting this function will reset alarms that are not autoresetting. It will also return the unit to normal mode if the unit has locked to bypass due to too many transfers to bypass assuming transfer back to normal operation is enabled.

Pressing Menu button will return the display to Menu display.

#### 8.3.2.8 Display Data

This display shows information about the display software: revision, compilation date and check sum. To adjust the contrast or select a different language push ↵ button down during three seconds. These options can be scrolled through ↑ and ↓ buttons.

Pressing Menu button will return the display to Menu display.

### 8.4 Using the maintenance bypass switch

The UPS unit is provided with a maintenance bypass switch. This switch is used to bypass the UPS during maintenance or servicing.

Maintenance bypass switch is located behind the door.

The maintenance bypass switch is a three position switch having the following positions:

- |                     |   |
|---------------------|---|
| <b>UPS -</b>        | normal position, input power is supplied to rectifier and bypass inputs and when the UPS is turned on inverter/static switch is supplying power to the load. In 20-30 kVA units OFF-position.   |
| <b>BYPASS-</b>      | the UPS is mechanically bypassed and the load is supplied from the bypass input power line. This position allows testing of the UPS without disturbing the load. In 20-30 kVA units OFF position. When the 20-30 kVA UPS is turned off and the maintenance bypass switch is in bypass position, the UPS is isolated from the input and output power lines.                  |
| <b>MAINTENANCE-</b> | only in 40-80 kVA units. The UPS is mechanically bypassed and the load is supplied from the bypass input power line. When the UPS is turned off and the maintenance bypass switch is in maintenance position the UPS is isolated from the input and output power lines. Also the neutral is isolated from the electronic parts. This position allows servicing of the unit. |

**Note!**

This switch is used only on rare occasions. Using of the switch does not cause any break in the output voltage, if the input frequency is accepted and the unit is synchronised to the input mains.



#### **WARNING!**

**If the input frequency is not correct and the UPS is not synchronised to mains, the use of the maintenance bypass switch will cause a short break in the output voltage.**

## Going to the bypass mode

Before going to bypass mode check from the display that the unsynchronised alarm is not active. Press “Menu” button and see the UPS status by pressing ↵ button. Turn the maintenance bypass switch into the ‘Bypass’-position.

## Going to the Service mode (only in 40-80 kVA UPSes)

Shut down the UPS according shutting down procedure in chapter 8.2. Turn the maintenance bypass switch to the ‘Maintenance’ position.

## Returning to normal mode

If the maintenance bypass switch is in ‘Maintenance’ position (only in 40-80 kVA UPSes) turn the maintenance bypass switch into the ‘Bypass’ position. Start up the UPS according start up instructions in chapter 8.1.

# 9. Maintenance

**All operations inside the unit must be carried out only by a service engineer from the manufacturer or from an agent, authorized by a manufacturer.**

## Battery maintenance

The condition of the batteries is crucial to correct operation of the UPS. The UPS units are provided with the automatic battery test ABM, which continuously controls the condition of the battery bank. When the capacity of the battery bank has decreased remarkably, the UPS will indicate this by audible and visual alarms.

In addition to the automatic battery test it is recommended that a battery discharge test is done once or twice per year. This test is recommended to be done together with the preventive maintenance by service engineer from the manufacturer or by an agent authorised by the manufacturer.

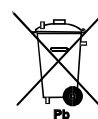
## Scrapping the UPS

Before scrapping UPS or its battery cabinet, battery bank and the lithium battery on the logic board must be removed. Due to high energy and high voltage, removal of batteries is allowed only for authorised service personnel. Local requirements must be followed in battery recycling or discard.



**WARNING!**

**HAZARDOUS MATERIALS.** Batteries may contain **HIGH VOLTAGES**, and **CAUSTIC**, **TOXIC** and **FLAMMABLE** substances. Batteries can injure or kill people and damage equipment if used improperly. **DO NOT DISCARD** unwanted batteries or battery material in the public waste disposal system. Follow **ALL** applicable, local regulations for storage, handling and disposal of batteries and battery materials.



# 10. Warranty

The product is warranted against defects in material and workmanship for a period of 12 months from its original date of purchase.

# 11. Technical specifications

## 1. General

- 1.1 Rated power 20 kVA, 30 kVA, 40 kVA, 50 kVA, 60 kVA, 80 kVA;  
at p.f. 0,7, inductive or non linear load
- 1.2 Technology Double conversion online topology with automatic  
bypass switch and maintenance bypass switch.  
Voltage and Frequency Independent operation:  
Class VFI-SS-111 by IEC 62040-3

## 2. Input

- 2.1 Rated voltage 220/380, 230/400, 240/415 Vac; three phase input  
(3xL+N+PE)
- 2.2 Voltage range 170/294-279/484 VAC without depleting battery  
20-50 kVA and 80 kVA  
180/312-279/484 VAC without depleting battery  
60 kVA 196/336-279/484 VAC full charge capability
- 2.3 Rated frequency 50/60 Hz
- 2.4 Frequency range for rectifier 45 - 65 Hz
- 2.5 Nominal/max input current 20 kVA 3 x 21 A / 3 x 30 A  
30 kVA 3 x 36 A / 3 x 45 A  
40 kVA 3 x 47 A / 3 x 65 A  
50 kVA 3 x 60 A / 3 x 80 A  
60 kVA 3 x 70 A / 3 x 93 A  
80 kVA 3 x 97 A / 3 x 125 A
- 2.6 Input power factor > 0.96 (Cosphi 1)

## 3. Output

- 3.1 Nominal voltage 220/380, 230/400, 240/415 VAC, selectable
- 3.2 Voltage regulation <  $\pm 1\%$  static  
<  $\pm 1\%$  with 100% unbalanced load  
<  $\pm 5\%$  dynamic at 100% load change  
Recovery time < 1 ms
- 3.3 Voltage distortion < 1 % THD linear load  
< 5 % THD non linear load
- 3.4 Frequency 50/60 Hz, selectable
- 3.5 Frequency regulation Synchronisation to line,  $\pm 0.5$ ,  $\pm 1.0$  or  
 $\pm 2.0$  Hz selectable.  
Free-running  $\pm 0.05$  Hz  
Slew rate 0.5, 2.5, 6 Hz/sec, selectable
- 3.6 Over load 101% to 110% for 10 minutes (online)  
111 - 125% for 60 sec (online)  
126 - 150% for 30 sec (online)  
151 - 170% for 5 sec (online)  
125% continuous (bypass)  
1000% for one cycle (bypass)

## 4. Environmental

4.1 Ambient temperature	0° ... + 40°C operating +15°C ... +25°C recommended -25°C ... +55°C storage (without battery)
4.2 Ventilation	Fan cooling, temperature $\mu$ P monitored
4.3 Altitude	1000 m operating w/o derating 15 000 m during transportation
4.4 Humidity	15 ... 90% RH, non-condensing
4.5 Audible noise	< 55 dB(A) at 1 meter distance 20-30 kVA < 60 dB(A) at 1 meter distance 40-60 kVA < 65 dB(A) at 1 meter distance 80 kVA
4.6 Protection class	IP 21 S

## 5. Standards

5.1 Safety	IEC 60950, EN 50091-1-1 (1996)
5.2 Emissions	EN 50091-2 (1995)
5.3 Immunity	EN 50091-2 (1995)

Output power	20 kVA 14 kW	30 kVA 21 kW	40 kVA 28 kW	50 kVA 35 kW	60 kVA 42 kW	80 kVA 56 kW
Output rated current	3x29 A	3x43 A	3x58 A	3x72 A	3x87 A	3x116 A
Output peak current (300 ms)	3x115 A	3x115 A	3x128 A	3x190 A	3x190 A	3x250 A
Efficiency (p.f.07)	94%	94%	93%	93%	93%	93%
Power dissipation	1100 W	1300 W	2100 W	2600 W	3100 W	3900 W
DC-voltage	2x288 (2x192) V	2x288 V	2x288 V	2x288 V	2x288 V	2x288 V
Internal batteries	2x48x7 Ah (2x32x7 Ah)	2x48x7 Ah	-	-	-	-
Weight	490 (400) kg	490 kg	230 kg	260 kg	260 kg	280 kg
Width	520 mm	520 mm	520 mm	520 mm	520 mm	520 mm
Depth	788 mm	788 mm	788 mm	788 mm	788 mm	788 mm
Height	1530 mm	1530 mm	1530 mm	1530 mm	1530 mm	1530 mm

The number indicated in parentheses are for units with battery banks of 32 pcs battery system.

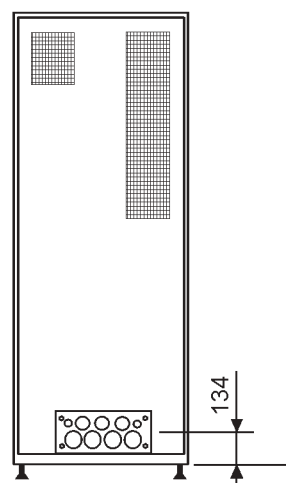
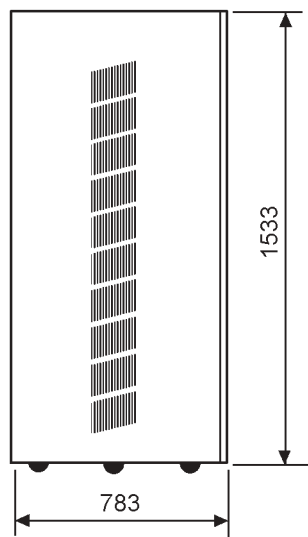
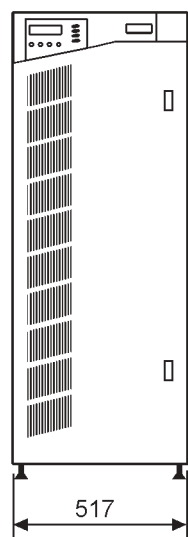
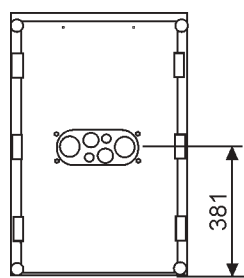
External battery cabinets with standard sealed lead-acid batteries and with long life batteries.

	BAT D	BAT D WIDE	BAT E	BAT F
DC-voltage	2x288 V	2x288 V	2x288 V	2x288V
Batteries	2x24x24 Ah	2x24x24 Ah	2x24x38 Ah	2x24x65 Ah
Weight	550 kg	580 kg	815 kg	1390 kg
Width	382 mm	520 mm	520 mm	1034 mm
Depth (mm)	788 mm	788 mm	788 mm	788 mm
Height (mm)	1530 mm	1530 mm	1530 mm	1530 mm

Note!

Battery cabinet F consists of two cabinets but total width is 1034 mm.

Appendix A – Dimension drawings 20-30 kVA UPS



Appendix B – Dimension drawings 40-80 kVA UPS

